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Skin Damages among healthcare workers caused by enhanced infection-control measures during COVID-19 pandemic – A cross-sectional study from Saudi Arabia

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ABSTRACT

Background: The purpose of this study was to determine the prevalence of occupational skin diseases among health care workers during the COVID-19 pandemic in a general hospital in the center of Saudi Arabia. **Methods:** This cross-sectional study was conducted from March – May 2021, at King Khaled General Hospital, Al-Majmaah, Saudi Arabia. A self-administered online questionnaire was distributed among healthcare professionals. The questionnaire asked about the severity of skin damage and the frequency or duration of various infection-prevention measures. **Results:** About 68.2% had newly onset of obvious skin damage while 31.8 % didn't had the skin damages, 21.6% of the new onset of obvious skin damages on fingertips, 46.6% in hands, 22.4% in palms, 3.4% on the face, and 6.0% under the eyes. Around 30% of the symptoms at the damaged site had itching, 44.7% dryness, 12.8% burning/pain, and 12.8% had tenderness. Around 17% of the type of skin lesion was peeling, 28.2% fissure, 18.8% erosion/ulcer, 24.7% redness, 4.7% papule (pimples), and 7.1% were others. **Conclusion:** Due to heightened preventive measures, frontline doctors are at a higher risk of acquiring skin damage. To address the risk factors and limit skin damage, appropriate measures should be performed. For the best results, persistent instances should be referred to a dermatologist.

Keywords: COVID-19; protection; skin diseases, skin damage, side effects.

1. INTRODUCTION

The covid-19 disease was declared as a global pandemic in March 2020 (Zhu et al., 2020). Currently, many new cases of Covid-19 patients are being

detected all over the world, including Saudi Arabia. The first case detected in Saudi Arabia was on March 2nd, 2020 (Algaissi et al., 2020). In general, occupational skin diseases represent up to 30% of occupational diseases (De Craecker et al., 2008). Occupational contact dermatitis and mainly hand eczema account for 80% of all occupational skin diseases; early recognition and management can prevent chronic eczema, which is much more difficult to treat (Salvador et al., 2020). It is confirmed now that the virus can be transmitted by droplets as well as through surface contact. So, it is extremely important to keep hands clean and disinfected to prevent viral transmission. Moreover, the use of goggles, masks, and protective clothes are also essential for some health care workers. These measures can all result in injury to the skin and an increase in the incidence of occupational skin disease (Lan et al., 2020). Moreover, this can also result in the worsening of preexisting dermatoses (Darlenski et al., 2020). Since skin is the first defense against infections, so keep integrated is important in combating this pandemic (Tonicic et al., 2020).

A variety of occupational skin diseases have been reported in health care professionals during the pandemic, such as hand dermatitis, facial dermatitis and indentations, pressure urticaria, and acneiform eruptions (Ferguson et al., 2021; Lee et al., 2021; Pei et al., 2020; Afifi et al., 2022; Alshammrie et al., 2022). No data or published articles on occupational skin diseases among health care workers in Al-Majmaah, Saudi Arabia. Articles and data on this topic are very few in the whole kingdom. There have been several dermatologic diseases reported to be associated with PPE. Acne Mechanica can occur in health care workers because mechanical trauma from the mask and goggles can cause microcomedone rupture, resulting in inflammation. The mask and goggles also create a hot and humid environment, causing excessive sweat and sebum buildup on the face. This promotes the growth of bacteria (*Propionibacterium acnes*) and creates an ideal environment for acne (Lee et al., 2021).

Health care workers may develop erythema and indentation from pressure caused by prolonged wearing of goggles and masks. Common sites are the nasal bridge and cheeks. Occasionally, blisters or erosion can develop at the sites of pressure (Lee et al., 2021). Hand dermatitis is a major skin disease associated with increased hand hygiene in compilation with COVID-19 precautions. Hands are reported to be a common site affected during this pandemic. It may be caused by the occlusion effects of gloves, glove powder, soaps, and incomplete hand drying before donning gloves (Ferguson et al., 2021). In such cases, topical steroids are used to reduce inflammation, and intensive emollients are used to repair the skin barrier. When applying lipid-bearing emollients or barrier creams to the hands, do so at least 1 hour before shift. Before using PPE, healthcare workers should make sure their hands are completely dry to avoid an occlusive effect that will cause skin damage. Hand creams containing oil or petroleum should be avoided as they may cause glove damage (Lee et al., 2021).

More advanced protection increased working frequency, and longer wearing times of protective suits have all been linked to the appearance of facial skin lesions. The appearance of erythema was found to be related to protection level, working frequency, and the duration of wearing a protective suit (Pei et al., 2020). This study was carried out with an objective to measure the prevalence of occupational skin diseases among health care workers during the COVID-19 pandemic at a general hospital in the center of Saudi Arabia.

2. METHOD

It is a cross-sectional study conducted at King Khaled General Hospital, Al-Majmaah, Saudi Arabia, over a period of 3 months, from March to May 2021. All health care providers received a self-administered online questionnaire (physicians, nurses, and paramedics). The questionnaire asked about the severity of skin injuries as well as the frequency and duration of various infection-prevention strategies. SPSS version 26 was used to analyze the data. The data were analyzed using descriptive statistics (frequency and standard deviation). For qualitative data, the chi-squared test was used to determine group comparisons, with a p-value of less than 0.05 considered significant.

The ethics committee of the Ministry of Health gave their clearance with IRB No. 1442-1068179, and the participants gave their written consent. All information was kept private and solely utilized for the purposes of the study.

3. RESULTS

Table 1 shows the socio-demographic data of the participants. We included a total of randomly taken 340 participants who filled out our questionnaire according to the inclusion criteria. Most of our participants (57.6%) were males, and 42.4% of them were females. Only 22.4% of the participants were between 18 and 30 years old, 32.9% of them were between 31 and 40 years old, 28.2% were between 41 and 50 years old, 15.3% were between 51-60 years old and 1.2% was between 60 and 70 years old. Most of our participants (55.3%) were from the admission wards department, 18.8% were from the emergency department, 12.9% of them were from the ICU department, 9.1% of them were from dermatology clinic, 13.6 % of our participants were from the ENT clinic, 9.1% of

our participants were from ophthalmology clinic, 31.8% of participants were from operation room (OR), 9.1% of them were from radiology

Table 1 Sociodemographic characteristics of participants (n=340).

Parameter		No.	Percent
Gender	Male	196	57.6
	Female	144	42.4
Age	18-30 years	76	22.4
	31-40 years	112	32.9
	41-50 years	96	28.2
	51-60 years	52	15.3
	60-70 years	4	1.2
Department	Emergency Department	64	18.8
	Admission wards	188	55.3
	ICU	44	12.9
	other	44	12.9
Other	Dentist	4	9.1
	Dermatology clinic	4	9.1
	ENT clinic	6	13.6
	Operation room	4	31.8
	Ophthalmology clinic	4	9.1
	Radiology	4	9.1

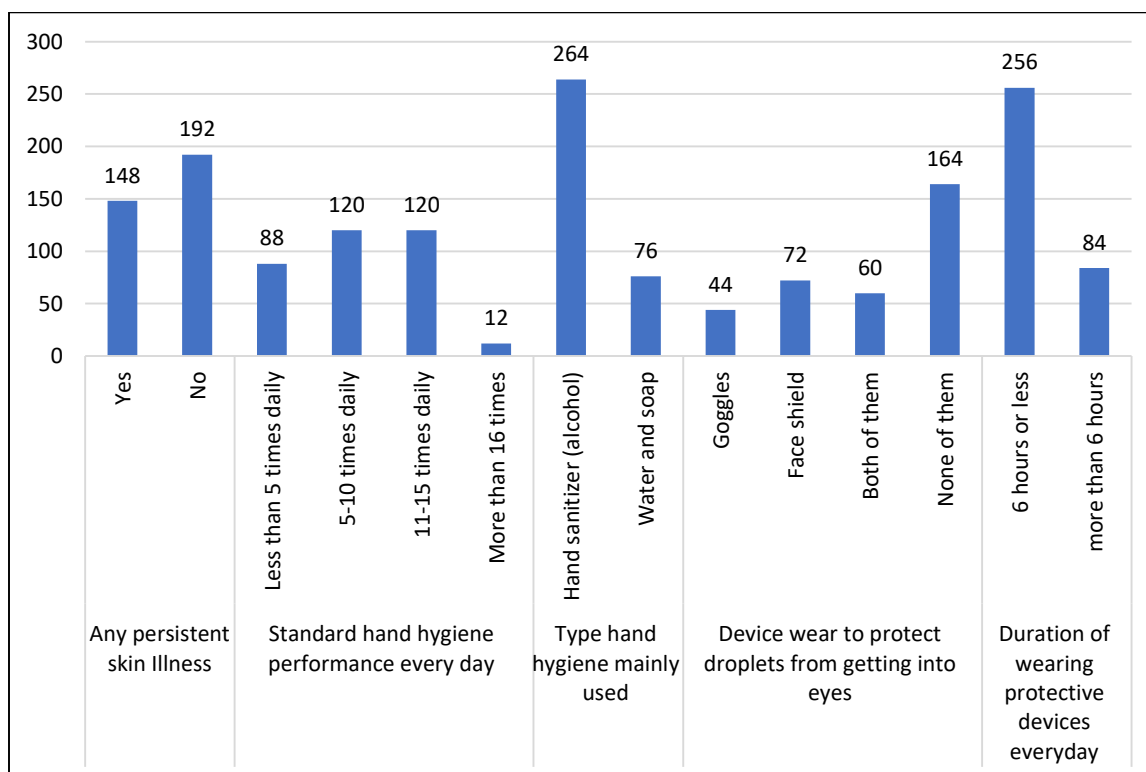


Figure 1 History of chronic skin problems, hand hygiene, duration of wearing protective devices (gloves, goggles, face shield or gown) every day, and new onset of skin lesions (n=340).

Figure 1 shows that 43.5% of our participants had a history of any chronic skin disease, such as hand eczema, atopic dermatitis, allergic dermatitis, 56.5% of them didn't have a history of any chronic skin disease, such as hand eczema, atopic dermatitis, allergic

dermatitis, 25.9% performed Standard hand hygiene every day Less than 5 times daily, 35.3% performed Standard hand hygiene 5-10 times daily. 35.3% were 11-15 times daily, and 3.5 were more than 16 times. 77.6% of the type of hand hygiene mainly used is hand sanitizers (alcohol), while 22.4 % were water and soap. 12.9% of devices worn to protect droplets from getting into eyes were goggles, while 21.2 were face shields. 17.6% wear both hands, 48.2% didn't wear any of them. 75.3% wear protective devices (gloves, goggles, face shield, or gown) every day for 6 hours or less, and 24.7% wear protective devices (gloves, goggles, face shield, or gown) every day for more than 6 hours.

Figure 2 shows that 68.2% of the participants had onset of obvious skin damage newly while, 31.8 % didn't have newly onset of obvious skin damage. 21.6 of the newly onset of obvious skin damages was in fingertips, 46.6% was in hands, 22.4% was in palms, 3.4% was in the face, and 6.0% was under the eye. Also, 29.8 % of the symptoms of the damaged site were itching, while 44.7 % was dryness, 12.8% was burning/pain, and 12.8% was tenderness. 16.5% of the type of skin lesion was peeling, 28.2% was a fissure, 18.8% was erosion/ulcer, 24.7% was redness, 4.7 % was papule (pimples), and 7.1% were others.

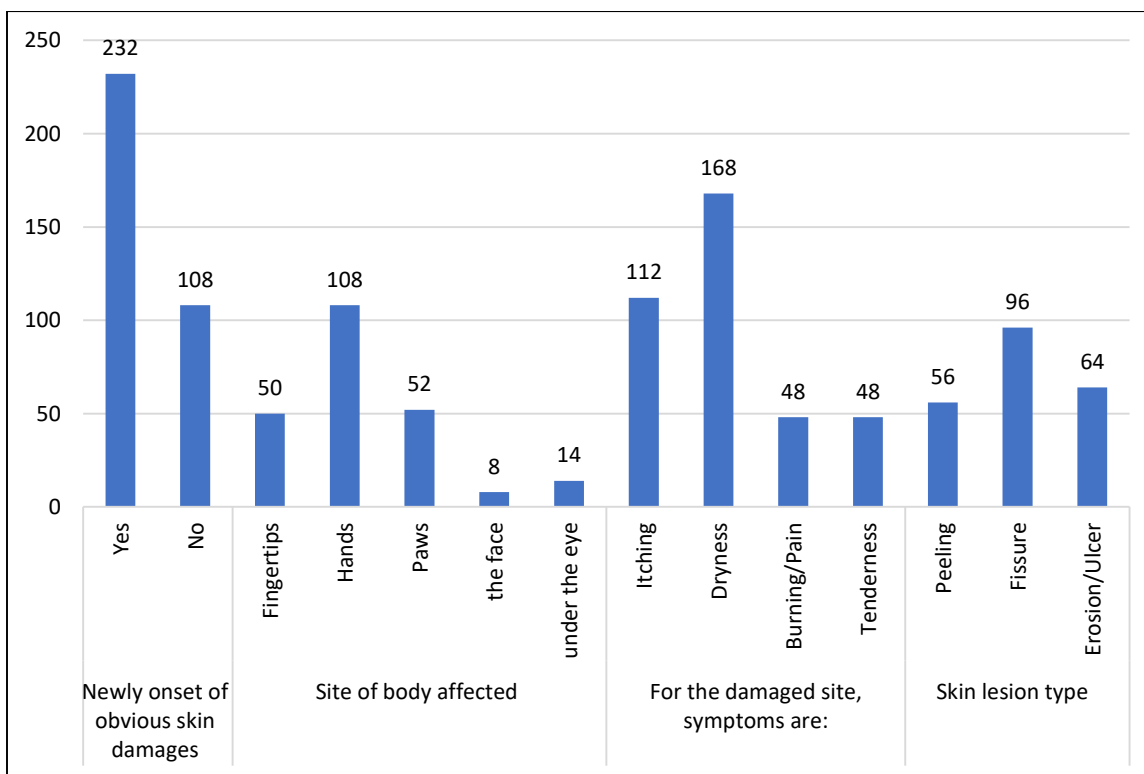


Figure 2 Site of body affected, symptoms for the damaged site and skin lesion types (n=340).

Table 2 illustrates the relationship between the occurrence of skin diseases and protection measures. There was a highly significant relationship between the presence of obvious new skin diseases and duration of wearing protective devices, type of mainly used hand hygiene, and frequency of standard hand hygiene performance every day ($P < 0.01$).

Table 2 The relationship between occurrence of skin diseases and protection measures (n=340)

		Newly onset of obvious skin damages		Total (N=340)	p-value
		Yes (n=232)	No (n=108)		
Duration of wearing protective devices (gloves, goggles, face shield, or gown) every day	6 hours or less	188	68	256	<0.001
		81.0%	63.0%	75.3%	
	more than 6 hours	44	40	84	
		19.0%	37.0%	24.7%	
Type of mainly used hand hygiene	Hand sanitizers (alcohol)	196	68	264	<0.001
		84.5%	63.0%	77.6%	
	Water and soap	36	40	76	
		15.5%	37.0%	22.4%	

Frequency of standard hand hygiene performance every day	Less than 5 times daily	72	16	88	<0.001
		31.0%	14.8%	25.9%	
	5-10 times daily	88	32	120	
		37.9%	29.6%	35.3%	
	11-15 times daily	72	48	120	
		31.0%	44.4%	35.3%	
	More than 16 times	0	12	12	
		0.0%	11.1%	3.5%	

4. DISCUSSION

Infection-prevention measures among HCWs have lately been linked to skin damage in a number of nations throughout the world. During the COVID-19 pandemic, our study raises awareness about the risk factors and prevalence of adverse skin reactions connected with infection-prevention methods, staff infection control measures, such as greater personal protective equipment (PPE) and more stringent hand hygiene practices, have resulted in an increase in the incidence of occupational skin disease among frontline workers (Ferguson et al., 2021). During the CPVID-19 epidemic, a cross-sectional study was undertaken at King Khaled General Hospital in Al-Majmaah, Saudi Arabia, to determine the prevalence of occupational skin disorders among health care workers at a general hospital in Saudi Arabia central region.

In our study, 68.2% of our participants had obvious skin damage during the pandemic, 90.6% of them were in the hands, and 9.4% was in the face. However, according to Akbulut et al., (2021), unfavorable skin reactions were reported by 79.5 percent of participants in his study, with the hands (63.5%) and face (48.9%) being the most commonly afflicted body parts in HCWs during the pandemic. Kiely et al., (2020) mentioned that in total, 82.6% of respondents reported skin lesions. The most commonly affected site hands in 76.47%, followed by the nose in 13.73% and cheeks in 12.55%. The impacted regions, according to Lan et al., (2020), were the nasal bridge, hands, cheek, and forehead, with the nasal bridge being the most typically affected (83.1 percent).

Skin changes were recorded by 41.5 percent of respondents, according to Saha et al., (2021); the hands were the most affected by 77.3 percent of doctors, followed by the nasal bridge, cheekbones, and retro auricular area. The most prevalent self-reported adverse skin reactions after wearing PPE, according to Yuan et al., (2021), were nasal bridge 54.25 percent, cheek 52.83 percent, forehead 25.94 percent, and auricle 21.70 percent. They're all out of sync with our numbers. In our study, 75.3% wear protective devices (gloves, goggles, face shields, or gowns) for 6 hours or less/day, and 24.7% wear protective devices for more than 6 hours/day. There was a highly significant relationship between the presence of obvious new skin diseases and the duration of wearing protective devices ($P < 0.01$).

According to Kiely et al., (2020), the dermatitis group used PPE for an average of 3.15 hours compared to the non-dermatitis group, which used continuous PPE for 1.97 hours. However, this difference was insignificant ($P = 0.211$) (Lan et al., 2019). Healthcare personnel who wore certain medical devices for more than 6 hours had a higher risk of skin injury in the affected areas than those who wore them for less time (Lan et al., 2020). Long-term PPE use caused unfavorable skin reactions; 78.18 percent of subjects wore PPE for more than 4 hours, with the longest wearing time being 10 hours (3, 1.09%) (Yuan et al., 2021).

In our study, 29.8 % of the symptoms of the damaged site were itching, while 44.7% was dryness, 12.8% was burning/pain, and 12.8% was tenderness. 16.5% of the type of skin lesion was peeling, 28.2% was a fissure, 18.8% was erosion/ulcer, 24.7% was redness, 4.7 % was papule (pimples), and 7.1% were others. Contact dermatitis, acne, and eczema were the most common conditions, according to Montero- Vilchez et al., (2021), with itching and burning being the most common symptoms. According to Kiely et al., (2020), the most commonly reported symptom was dry skin, which impacted 75.37 percent of employees. Redness was mentioned by 36.94 percent, while itching was mentioned by 27.61 percent.

According to Song, (2020), 4.9 percent of people did not have any symptoms, but the most common ones were pruritus (45.5 percent), burning (3.9 percent), and stinging (2.9 percent). Compound symptoms such as itching and burning were found in 38.6%, being the most common. Guertlier et al., (2020) found that all HCWs had a significant incidence of self-reported symptoms related with hand eczema. Dryness was the most common complaint (83.2%), followed by erythema (38.6%), itching (28.9%), burning (21.1%), scaling (18.4%), fissures (9.6%), and pain (9.6%). According to Lan et al., (2020), dryness/tightness and desquamation were the most common complaints within a set of symptoms (70.3%). The most common clinical symptoms, according to Saha et al., (2021), were dryness (84.1%) and skin peeling (79.5%). Yuan et al., (2021) reported that pressure was mostly felt under a nasal bridge in 78.54%, cheek in 70.55%, forehead in 55.63%, and auricle in 52.36%.

5. CONCLUSION

Increased usage of various PPE to combat COVID-19 can result in a number of negative skin consequences. In our study, 68.2% of our participants had obvious skin damage during the pandemic, 90.6% of them were in the hands, and 9.4% was in the face. Itching, dryness, burning, discomfort, and tenderness were the most prevalent side effects reported from contact dermatitis. As a result, it's critical to hold training sessions on the prevention and treatment of potential skin lesions caused by the use of personal protective equipment (PPE) in accordance with industry standards.

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Author Contributions

Author Salim Ali Algaadi has conceptualized the study and played primary role in compiling, analyzing and interpretation of the data. All the drafts were prepared, reviewed, and the final draft was approved by Saleh Asaad Hamad Alsaadoon, Abdulrahman Ali Abdullah Alqabbani, Saud Abdulaziz Saud Alomair. Saleh Asaad Hamad Alsaadoon and Saud Abdulaziz Saud Alomair have contributed to fine-tuning of the proposal, contributed in data collection and entry. Abdulaziz Saqer A Alanazi, Abdulrahman Ali Abdullah Alqabbani reviewed the results and contributed to the preparation and review of drafts. All the authors have read and approved the final version of the manuscript. All the authors take complete responsibility for the content of the manuscript.

Ethical approval

The study was approved by the ethics committee of the Ministry of Health gave their clearance with IRB No. 1442-1068179.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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